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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,561	05/19/2005	Brian A. Gregg	NREL 03-15	7494

7590

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EXAMINER
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DIAMOND, ALAN D

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 08/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/535,561

Applicant(s)

GREGG, BRIAN A.

Examiner

Alan Diamond

Art Unit

1753

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --****Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 31 May 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 3-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Comments***

1. The petition filed May 31, 2006 to correct the provision application priority claim in this 371 application is still pending with the Office of Petitions. Accordingly, the error indicated with respect to the priority claim is restated below. The objection to the inventor's declaration has been overcome by the inventor's declaration filed May 31, 2006.
2. The 35 USC 112, second paragraph, rejection of claims 9 and 16 has been overcome by Applicant's amendment of the claims.

### ***Priority***

3. It appears that the provisional application for which priority is claimed, i.e., 60/503,335 filed September 16, 2003 is in error. Said 60/503,335 has nothing to do with the instant specification and claims and has no inventor in common with the instant application. Since the instant application is a 371 of PCT/US04/30201, which claims the benefit of 60/503,335, it appears that Applicant will have to correct the provisional application serial number through the PCT branch since in order for the instant continuity to be corrected, the PCT continuity would also have to be corrected. It noted that the inventor's declaration filed May 31, 2006 refers to 60/503,336 for priority. The permission to claim this priority will depend on the decision of the petition filed May 31, 2006 to correct the provision application priority claim.

### ***Claim Objections***

4. Claims 5 and 21 are objected to because of the following informalities: In claim 5, at line 1, the word "included" should be changed to "includes". In claim 21, at line 4, the term "a interfacial" should be changed to "an interfacial". Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 is now indefinite because it is not clear which first semiconductor layer is being referred to by the term "first semiconductor layer" at line 2. It is suggested that said term be changed to "the first semiconductor layer" as it appeared in originally filed claim 12.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 3-7, 10-12, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cordaro (U.S. Patent Application Publication 2002/0157702).

Cordaro prepares a solar cell comprising a p-type layer (24) comprising p-type pigment particles (40) mixed in a binder matrix (44) that can be an epoxy matrix; and, in contact with the p-type layer (24), there is an n-type layer (26) comprising n-type pigment particles (46) mixed in a binder matrix (50) that can be an epoxy matrix (see paragraphs 0031 to 0038; and Figure 2). The materials used for the n-type and p-type pigments are typically crystalline, and the diameters of the n-type and p-type pigments can be 0.1 micron, i.e., 100 nm (see paragraphs 0031 and 0035). The substrate (62) for the solar cell can be flexible with an electrically conductive coating (32). The p-type layer (24) can contain electrically conductive filler particles (42) (see paragraph 0031); and the n-type layer (26) can contain electrically conductive filler particles (48) (see paragraph 0035). The p-type layer (24) and the n-type layer (26) are not limited to any particular thickness (see paragraphs 0034 and 0038), and thus, the thickness of less than about 250 nm, as here claimed, would have been within the skill of an artisan. Cordaro teaches the limitations of the instant claims other than the difference which is discussed below.

Cordaro does not specifically teach that its conductive filler particles (42) and conductive filler particles (48) are anions and cations, respectively. However, as noted above, said filler particles (42) and (48) can be electrically conductive. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided said filler particles (42) and conductive filler particles (48) as anions and cations, respectively, so that a working solar cell could be prepared. The anion particles in the p-type layer would be uncompensated because there are no cation particles

present in the p-type layer. The cation particles in the n-type layer would be uncompensated because there are no anion particles in the n-type layer. As seen in Cordaro's Figure 1, there are uncompensated conductive particles (42) in the p-layer proximal to the p-n interface, and there are uncompensated conductive particles (48) proximal to the p-n interface.

9. Claims 8, 9, 13, and 17-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cordaro as applied to claims 1, 3-7, 10-12, and 14-16 above, and further in view of JP 2003-332600 (herein referred to as JP '600). The instant claims are not supported by provisional Application 60/503,335, and thus have a filing date of 09/16/2004. JP '600 has a 102(a) publication date of 11/21/2003.

Cordaro, as relied upon for the reasons recited above, teaches the limitations of instant claims 8, 9, 13, and 17-33, the difference being that Cordaro does not specifically teach that its n-type and p-type semiconductor particles are organic. However, organic n-type and p-type semiconductor particles are known in the art for use in solar cells, as shown by JP '600 (see the entire document). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used organic n-type and p-type semiconductor particles for the n-type and p-type semiconductor particles in Cordaro's solar cell because organic n-type and p-type semiconductor particles are known in the art for use in solar cells, as shown by JP '600.

10. Claims 8, 9, 13, 17-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cordaro as applied to claims 1, 3-7, 10-12, and 14-16 above, and further in view of Bulovic et al (U.S. Patent 6,352,777).

Cordaro, as relied upon for the reasons recited above, teaches the limitations of instant claims 8, 13, 17-24, and 26-33, the difference being that Cordaro does not specifically teach that its n-type and p-type semiconductor particles are organic. However, the use of organic semiconductors is well known in the art as shown by Bulovic et al (see the entire document). In particular, in Bulovic et al's Table 1 bridging cols. 28 and 29, there are seen various n-type and p-type organic semiconductor pairs. Examples of the semiconductors in said Table 1 include TiOPc and PPEI. It is the Examiner's position that PPEI renders obvious the use of PPyEI. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used organic semiconductor materials for Cordaro's n-type and p-type semiconductor particles because n-type and p-type semiconductor materials are well known in the art, as shown by Bulovic et al.

### ***Response to Arguments***

11. Applicant's arguments filed May 31, 2006 have been fully considered but they are not persuasive.

Applicant argues that Cordaro's filler particles are not taught as being electrically conductive. However, this argument is not deemed to be persuasive because Cordaro specifically teaches that is filler particles (42) and (48) can be doped so as to impart additional electrical conductivity in the manner discussed by U.S. Patent 6,099,637, which is hereby made of record (see paragraphs 0031 and 0035 of Cordaro). The '637 patent teaches doping of cationic or anionic dopants in its particles (see col. 4, lines 32-41).

Applicant argues that Cordaro fails to show mixing in cation additives to the n-type nanocrystalline semiconductors and anion additives to the p-type nanocrystalline semiconductors; and that motivation to do so is coming from Applicant's specification. However, these arguments are not deemed to be persuasive because the Examiner maintains that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided said filler particles (42) and conductive filler particles (48) as anions and cations, respectively, so that a working solar cell could be prepared. A skilled artisan would readily recognize that the conductive particles added to a p-type (positive) layer of a solar cell should be anionic, and the conductive particles added to an n-type (negative) layer should be cationic in order to aid in electrostatic charge dissipation, as desired by Cordaro (see paragraphs 0031 and 0035).

Applicant argues that claim 4 calls for the binder to be epoxy. However, this argument is not deemed to be persuasive because Cordaro specifically teaches an epoxy binder (see paragraphs 0032 and 0036).

Applicant argues that claim 5 calls for applying heat and pressure. However, this is not deemed to be persuasive because when one of Cordaro's layers is first partially dried, and then the second layer is applied and dried (see paragraphs 0068 and 0069). There is heat and pressure applied from the environment. The atmosphere supplies about 14.7 psi, and the room temperature of the environment supplies the heat to dry the layers.

Applicant argues that there is no teaching of creating a local electrical field at the heterojunction interface. However, this argument is not deemed to be persuasive



Art Unit: 1753

because the instant claims are silent concerning such an electrical field. The Examiner would be willing to allow each of the instant independent claims if they were further amended so as to recite language similar to what is recited at page 5, lines 6-10, of the specification. For example, for claims 1 and 17, a recitation at the end of the claim could be “, and wherein an electric field is formed integrally at the interface rather than uniformly across the cell.” For claim 11, the recitation could be “, and wherein an electric field is formed integrally at the p-n heterojunction rather than uniformly across the cell.”

Applicant argues that there is no teaching or suggestion of “spatially bound” cations or anions. However, this argument is not deemed to be persuasive because each of Cordaro’s particles is spatially bound in a matrix as clearly seen in Figure 1.

With respect to JP ‘600, Applicant argues that they are changing the priority to provisional application 60/503,336 instead of 60/503,335. However, it is noted that Applicant’s petition for this change has not yet been approved.

Applicant argues that Bulovic does not solve a deficiency of Cordaro. However, the Examiner maintains that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used organic semiconductor materials for Cordaro’s n-type and p-type semiconductor particles because n-type and p-type semiconductor materials are well known in the art, as shown by Bulovic et al.

Applicant argues that the Office has failed to establish a prima facie case of obviousness for claims 18, 19, and 21-23. However, this argument is not deemed to be persuasive because, with respect to claim 18, determination of an appropriate

Art Unit: 1753

concentration of Cordaro's n-type and p-type particles in their respective layers would have been within the level of ordinary skill in the art. With respect to claim 19, the use of Cordaro's conductive filler particles in salt form would have been within the skill of an artisan. With respect to claims 21-23, removing ions would have been within the skill of an artisan, absent anything unexpected.

### ***Conclusion***

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

Art Unit: 1753

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Alan Diamond  
Primary Examiner  
Art Unit 1753

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a stylized flourish at the end.

Alan Diamond  
August 4, 2006